METHYL BROMIDE

Methyl bromide is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 74-83-9 CH_3Br

Molecular Formula: CH_3Br

Methyl bromide is a colorless, transparent, volatile liquid or gas. It is usually odorless except at high concentrations where a sweetish, chloroform-like odor occurs and it has a burning taste. Methyl bromide is nonflammable in air, but burns in oxygen (Merck, 1983). It is freely soluble in alcohol, chloroform, ether, carbon tetrachloride, carbon disulfide, and benzene, and forms a voluminous crystalline hydrate with cold water (Sax, 1987).

Physical Properties of Methyl Bromide

Synonyms: bromomethane; monobromomethane; Embafume

Molecular Weight:	94.95
Boiling Point:	3.6 ^oC
Melting Point:	-93.66 ^oC
Vapor Density:	3.3 (air = 1)
Density/Specific Gravity:	1.730 at 0/4 ^oC (liquid)(water = 1) 3.974 g/l at 20 ^oC (gas)
Vapor Pressure:	1420 mm Hg at 20 ^oC
Log Octanol/Water Partition Coefficient:	1.19
Water Solubility:	17,500 mg/l at 20 ^oC
Henry's Law Constant:	6.24 x 10^{-3} atm m^3/mole
Conversion Factor:	1 ppm = 3.9 mg/m^3

(Howard, 1990; HSDB, 1991; Merck, 1983; Sax, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Methyl bromide is used in ionization chambers, in degreasing wool, extracting oil from nuts, seeds, and flowers. It is also used as a methylating agent and as a solvent in aniline dyes (HSDB, 1991).

Methyl bromide is registered as a fumigant. It is used for pre-plant soil sterilization, for the

control of soil-borne fungi, insects, and nematodes, for controlling miscellaneous arthropods (sow-bugs, spiders, millipedes), annual and perennial grasses and broadleaf weeds, in a variety of pre-plant agricultural settings. It is also registered as a fumigant/insecticide for post-harvest sterilization of fresh fruits, vegetables, and nuts; ornamental plants, storage tanks and areas, structures, food processing plants, and dried fruit producing plants (DPR, 1996).

The licensing and regulation of pesticides for sale and use in California are the responsibility of the Department of Pesticide Regulation (DPR). Information presented in this fact sheet regarding the permitted pesticidal uses of methyl bromide has been collected from pesticide labels registered for use in California and from DPR's pesticide databases. This information reflects pesticide use and permitted uses in California as of October 15, 1996. For further information regarding the pesticidal uses of this compound, please contact the Pesticide Registration Branch of DPR (DPR, 1996).

The primary stationary sources of methyl bromide in California are wholesale grocery and related products industry, wholesale chemicals and allied products, and sugar and confectionery manufacturers. Other major sources in California that have reported emissions of methyl bromide are canned specialties, fruits and vegetable facilities, rice milling, malt beverage and coffee roasting facilities, agricultural chemical facilities and farm product warehouse and storage, marine cargo handling, and colleges and universities (ARB, 1997b).

B. Emissions

The total emissions of methyl bromide from stationary sources in California are estimated to be at least 100,000 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Methyl bromide is produced by a variety of marine organisms (HSDB, 1991).

AMBIENT CONCENTRATIONS

At the request of DPR, the Air Resources Board conducted ambient air monitoring from August 26 to September 18, 1986, in Monterey County to coincide with application of methyl bromide to strawberry fields for control of nematodes. Of the 48 samples collected, only 2 had detectable amounts measured at the minimum detection limit of 1.1 parts per billion (ppb) (4.3 micrograms per cubic meter ($\mu g/m^3$)). Samples were also collected 4 days during and after an application to a strawberry field. The maximum concentrations found at 3 sites were 800, 2,060, and 3,500 $\mu g/m^3$ (205, 530, and 900 ppb) for 4-hour samples, with 53 out of 96 total samples having concentrations above the minimum detection limit (ARB, 1987d).

In June of 1992, the ARB conducted ambient air monitoring in Fresno County after venting of

a commodity fumigation chamber. The highest concentration was measured during the initial venting period (13,800 $\mu g/m^3$ average for a 20 minute sample); the levels decreased rapidly with time (ARB, 1992h).

The United States Environmental Protection Agency (U.S. EPA) has compiled ambient information from 35 United States urban and suburban locations from 1975-86. An overall range of 0 to 149 $\mu g/m^3$ (0 to 38.2 ppb) with an overall mean concentration of 8.83 $\mu g/m^3$ (2.26 ppb) was reported (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of methyl bromide was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

In the troposphere, the dominant chemical loss process for methyl bromide is the reaction with the hydroxyl (OH) radical. The calculated half-life and lifetime of methyl bromide due to reaction with the OH radical are 0.9 years and 1.3 years, respectively. The product of the OH radical reaction is formyl bromide. Photolysis is not of importance in the troposphere. Gas-water exchange into and from the oceans is important, both as a source and tropospheric loss process for methyl bromide (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer health effects, methyl bromide contributed to the total hazard index in 3 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1, and presented an individual hazard index greater than 1 in 2 of these risk assessments (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to methyl bromide are inhalation, ingestion, and dermal contact (Howard, 1990).

Non-Cancer: Exposure to methyl bromide may cause skin, eye, nose, throat, and upper respiratory tract irritation. Exposure may result in pulmonary edema and neurological effects. The central nervous system, liver, and kidneys are target organs (Sittig, 1991; U.S. EPA, 1994a).

A chronic non-cancer Reference Exposure Level (REL) of 6.0 $\mu g/m^3$ is listed for methyl bromide in the California Air Pollution Control Officers Association Air Toxics "Hot Spots"

Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the gastrointestinal system and liver (CAPCOA, 1993).

The U.S. EPA has established a Reference Concentration (RfC) of 5.0 $\mu g/m^3$ for methyl bromide based on degenerative and proliferative lesions of the olfactory epithelium of the nasal cavity in rats. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects. The U.S. EPA has established an oral Reference Dose (RfD) of 0.0014 milligrams per kilogram per day for methyl bromide based on epithelial hyperplasia in rats. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic, non-cancer effects (U.S. EPA, 1994a).

There is no evidence reported in animal studies, except at high exposure levels, that exposure to methyl bromide causes birth defects or interferes with normal reproduction. However, chronic exposure of male animals to high concentrations of methyl bromide by inhalation has resulted in effects on the testes (U.S. EPA, 1994a). The State of California has determined under Proposition 65 that methyl bromide in its use as a structural fumigant is a developmental toxicant (CCR, 1996).

Cancer: Results from human studies are inconclusive. The U.S. EPA has classified methyl bromide in Group D: Not classifiable based on inadequate human and animal data (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified methyl bromide in Group 3: Not classifiable as to its carcinogenicity to humans (IARC, 1987a).